Erosion Control

Product Acceptability Lists
for
Multi – Modal Applications

PAL

January 2001 Edition

EROSION CONTROL PRODUCT ACCEPTABILITY LISTS (PAL)

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EROSION CONTROL

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EROSION CONTROL
PRODUCT ACCEPTABILITY LISTS (PAL)

Introduction

Each year, the Wisconsin Department of Transportation (WisDOT), compiles the Erosion Control Product Acceptability Lists (PAL) for Erosion Mats, Soil Stabilizers, Tackifiers, inlet protection, and temporary ditch checks. All products in these lists shall meet the Department's Standard Specifications for Road and Bridge Construction. **Products included in these lists shall be manufactured with the same quality and composition as the test material originally submitted for evaluation.**

The lists below are organized into four major erosion control product categories. A section intended to clarify the criteria in the PAL and outline the general requirements for product acceptability supplements each category. The lists are updated quarterly and distributed to WisDOT engineering staff, erosion control manufacturers, distributors, contractors, consulting engineers and other interested parties. Any person interested in the status of a product or in obtaining a copy of the latest PAL may do so by contacting the persons listed on page v. This document is also referenced on the WisDOT Materials Laboratory Test (MLT) system and on the Intranet Construction Bulletin Board, for those with access to the WisDOT system.

All requested changes or additions to the PAL should be forwarded to the Bureau of Highway Construction at the address given on page v. Requests will be reviewed by the Department and acted upon in the months of January, April and September. **The PAL will be published in its entirety every January, and as needed, supplementals will be published in April and September.**

All installation instructions submitted by the manufacturer, or the distributor, to WisDOT shall contain reliable methods of installation for all of the following project locations applicable: slopes, channels, shorelines, high wind locations, and areas next to live traffic lanes. The manufacturer or distributor, as appropriate, shall send a copy of these instructions to:

1) The persons listed on page *vi*.
2) The contractor prior to the pre-construction conference for each project.
3) The contractor when the erosion control product is part of a project's contract change order.

Pal Submittal Procedure

To be included on WisDOT PAL, manufacturers will need to send complete product information to Wisconsin Department of Transportation by January 1 of each year to be included in the January edition. If an altered or a new product is to be considered for placement on the PAL, the Erosion Control and Storm Water (ECSW) Work Group must approve it. The approval process involves reviewing the product data submitted by the manufacturer or distributor.

WisDOT requires the following product information for product approval:

- Product sample size of approximately a 10 ft^2 (1.0 $m^{2)}$ sample will be required for mat and geotextile products; representative samples shall be included for all other products.

- Product Specifications, Product literature, Installation references, Field performance data, Lab test data (Certified lab results from a qualified laboratory capable of performing the required tests typically independent from Manufacturer's tests), any other state agency that has testing in progress, tests completed and/or product approval.

- A completed Product Preliminary Information Sheet (PIS) provided by WisDOT - Technology Advancement Unit, (See form sample in Appendix A).

Products passing lab tests are not guaranteed a place on WisDOT PAL. WisDOT standards must be met. WisDOT retains the right to make any changes, additions or deletions to the PAL as needed and also seek concurrence from the Wisconsin Department of Natural Resources on products' environmental compatibility. Products not environmentally compatible will be disallowed. For products to be approved and placed in their appropriate categories, certified lab results, as well as a statement of compliance with WisDOT standards, are required. Wisconsin DOT reserves the right to remove a product from the list when field performance proves to be unsatisfactory. The most recent PAL at the time of bid for any project remains valid for that project, however new products added to the PAL after the bid may be allowed on the project.

Product information submitted by the manufacturers to WisDOT will not be considered confidential unless otherwise noted.

Tackifiers must meet the minimum requirements of Michigan DOT. In addition, Wisconsin DOT does not approve asphalt based tackifiers or products deemed environmentally incompatible. Please contact Darwyn Heme of the Michigan Department of Transportation at (517) 322-3312 for additional information on the tackifier approval process.

EROSION MATS

WisDOT defines "erosion mat" as a manufactured blanket or mat that is delivered to the work site in rolls or strips, with a minimum thickness of 1/4 inch (6 mm). Erosion Control Mats are organized into three Classes of mats, which are further broken down into various Types. Each Type of mat must be capable of sustaining the required Minimum Product Permissible Shear Stress for the duration specified in the Class to which it is assigned.

The requirements listed below must be met for an erosion mat product to be considered in the WisDOT PAL. See also the WisDOT Facilities Development Manual, Procedure 10-10-15 for more information.

GENERAL SPECIFICATIONS

1. Shear Stress, Vegetative Enhancement & Slope Erosion Protection: Results from a preaproved hydraulics and erosion control laboratory will be submitted for approval of all erosion mats. Currently labs approved for testing are:

- Colorado State University contact: Dr. Chris Thorton (970) 491-8394
- San Diego State University contact: Mike Harding (619) 594-3123
- E-Lab contact: Tony Johnson (715) 234- 6861
- Texas Transportation Testing Institute contact: Jett Mcfalls (979) 847-8709

Reports to WisDOT are to include but not limited to:

1. Procedure
2. Site conditions
3. Geotechnical information
4. Material type and installation
5. Calibration
6. Test set up.
7. Test procedure and data collection.
8. Analysis and data interpretation including the revised universal soil loss index number, shear stresses for channels, channel velocity, energy slope and Manning's resistance coefficient.
9. Summary of tests results, Cover Management (C) Factor according to the Revised Universal Soil Loss Equation (Rusle) from the USDA-ARS Agricultural handbook 703 for slopes, shear at .5 in of soil loss with projected soil loss exceeding shear in graphical format for channel testing.
10. Conclusions and recommendations.
11. All raw data and calculations.

2. Minimum Product Permissible Shear Stress: "Minimum Product Permissible Shear Stress" is the minimum shear stress that an erosion mat must attain in a bare soil channel while maintaining a specified level of performance. All approved erosion mats must meet

the Minimum Product Permissible shear stress requirements for the category that they have been assigned to while maintaining a level of soil protection. Failure in shear is defined by the loss of ½ inch of soil in the channel. The ½ inch of soil loss is defined for this test as the average sums of the soil degradation not to include areas of soil aggregation.

Modifications to ASTM D6460-99 as decided are as follows:

1. 3.1.1 should read: A degradable or synthetic material manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment, and protection of vegetation
2. 7.1.2 Test in one soil type. Soil to be a silty loam defined by particle size distribution band shown in figure 4.
3. 3 channel runs with erosion mat for each channel to be from a different lot of material.

3. **Slope Erosion Protection:** Slope Erosion Protection is the ability to protect a slope from soil loss due to rainfall splash and sheet flow. Results from a pre approved hydraulics and erosion control lab using ASTM D6459-99 will be accepted.

Modifications to ASTM D6459-99 are as follows:

1. 3.1.1 Remove to allow synthetic material.
2. 7.1.2 Test in one soil type. Soil to be a silty loam defined by particle size distribution band shown in figure 4.
3. 3 soil plots with 3 rainfall intensities of 2,4, and 6 inch per hour events. Erosion mat for each plot to be from a different lot of material.
4. 7.1.1 and 7.1.3 Change slope length to allow a shorter plot. Minimum of 30 feet instead of 40 feet.

Failure will be defined by soil loss not to exceed a Cover Management (C) Factor of 0.20 according to the Revised Universal Soil Loss Equation (Rusle) from the USDA-ARS Agricultural handbook 703.

4. **Vegetative Enhancement:** results for vegetative enhancement will be submitted from a recognized testing facility. All erosion mats in the PAL must allow vegetation to achieve the following minimum vegetative density when compared to mulched soil;

A) 70% for sandy soils
B) 80% for clay soils

This percentage will be determinate as compared to a mulched soil test. Mulch to be applied at the according to section 627 of the WisDOT standard specifications or as a .125 in. covering of a loose soil evenly distributed topsoil. Watering should be performed at documented intervals at a specified rate. Results for vegetative enhancement will be observed after the first year of installation as compared to a previously undisturbed area.

5. **Interim Acceptance:** Test results from an approved lab will be accepted for interim approval of mats in a class II designation or I. Tests performed following the Erosion Control Technology Council (ECTC) Method 2; A Bench Scale Test for Determining the RECP Performance in Rainfall Splash (Slope Erosion) and ECTC Draft Method 3; A

bench Scale Test for Determining the Performance in Protecting Soil from Hydraulic Shear Stress (Channel Erosion) will be accepted. The Germination tests have no option for interim testing, tests for germination enhancement will accompany all submittals.

6. **Recertification:** Recertification of products on a 3 year cycle will be required for products to remain on the approved list. Recertification will require the products to be tested through the American Association of State Highway and Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP) Erosion Control Products Panel. Products will adhere to the NTPEP cycle regardless of date of application.

   Please contact the NTPEP Coordinator, Mujeeb Basha at (202) 624-5800 for more information on the testing program.

7. **Channel Restrictions:** Single roll widths less than 6 ft (1.8 m) will not be allowed in channels.

8. **Mat Entrenchment:** All erosion mats installed within 5 feet (1.52 m) of active traffic lanes or airport runways / taxiways shall be entrenched approximately 3 inches (75 mm) deep along the edges facing the traffic.

9. **Airport Restrictions:** The following apply to **ALL** airport projects:

   A. Only Class I, Urban erosion mats that are double netted shall be allowed within 10 feet (3.05 m) of any airport pavement used by aircraft with the exception of airports classified as air carrier or corporate/transport. If the airport is classified as an air carrier or corporate/transport, there will be no erosion mats allowed within 30 feet (9.14 m) of pavement used by aircraft.

   B. Only biodegradable anchoring devices shall be allowed in the installation of any erosion mat for airport applications. Biodegradable anchoring devices shall meet the requirements specified for Class I, Type Urban erosion mat anchoring devices. No metal staples will be allowed.

10. **Random Sampling Of Products:** Once a product is on the PAL, random sampling will be conducted by WisDOT for comparison with the samples originally submitted to the State for approval. Comparative testing will be done against the representative sample.

    Inconsistencies between product samples may result in the product's removal from the PAL until recertification is provided and compliance is established by the Erosion Control Storm Water Committee (ECSW).

11. **Modification To An Approved Product:** The product quality or composition must not be changed in any way after the erosion mat product has been placed on the PAL unless WisDOT has approved these changes via the PAL Submittal Procedure on page iv of this document. Changes made without proper notice and adherence to standard procedures will result in the removal of the product from

the PAL.

12. **Installation Instructions And Procedures:** All installation instructions submitted by the manufacturer, or the distributor to WisDOT shall contain reliable methods of installation for each of the following project locations; slopes, channels, shorelines, high wind locations, areas next to live traffic Lanes, and airport runways. The manufacturer or distributor, as appropriate, shall send a copy of these instructions to:

    A. The address listed in the PAL Submittal Procedure on page *vi.*

    B. The contractor prior to the pre-construction conference for each project.

    C. The contractor when the erosion mat is part of a project's contract change order.

    Installation procedures must insure that the mat will remain in contact with the soil.

    Both the product and installation method, together, will determine performance. The failure of a product to perform acceptably will result in removal from the PAL list.

13. **Netted Photodegradable Products:** Erosion mats **TYPE 1 CLASS A** that are netted photodegradable products shall not be installed after September 1st. These products have a design life that lasts only 6 to 8 weeks. After this time has passed the products exhibit loss in strength and structural integrity. Proper time must be allowed for these products to establish vegetation prior to winter months. It has been shown that products installed after the September 1st deadline will not perform through the winter months and the following spring to allow vegetation to be established.

    These products do not degrade rapidly enough to be included in the **CLASS 1, TYPE URBAN** category.

CLASS AND TYPE SPECIFICATIONS

CLASS I

A short term duration (6 months or greater), light duty, organic, "Erosion Control Revegetative Mat" (ECRM). Non-organic, photodegradable or biodegradable netting allowed.

For those Class I mats that have a netting attached, the netting shall be photodegradable and/or biodegradable as specified for that Class and Type of mat. The weight of the netting shall not exceed 15% of the total blanket weight.

The netting shall be bonded sufficiently to the parent material to prevent separation of the net from the parent material for the life of the product. This is particularly important as the vegetation starts to grow. If not sufficiently bonded

the net has a tendency to float, which causes damage to maintenance equipment when slopes are mowed and increases the risk of animals being caught in the netting.

TYPE A
Minimum Product Permissible Shear Stress: 1.0 lbs/ft²(50Pa):
A netted product for use on slopes 2.5:1 and flatter. **Not to be used in channels.**

TYPE B
Minimum Product Permissible Shear Stress: 1.5 lbs/ft²(70Pa):
A double netted product for use on slopes 2:1 or flatter, or, in channels here the calculated (design) shear stress is 1.5 lbs/ft² (70 Pa) or less.

URBAN - Not to be used in channels
A short term duration (6 months or greater), light duty, organic, "Erosion Control Revegetative Mat" (ECRM) meant for use in urban areas, or lawns, where mowing may be accomplished within two weeks with little or no snagging of the netting or mat.

All installed Type Urban mats shall conform to the requirements for Erosion Mats, with the following modifications:

1. Only 100% organic biodegradable netted products are allowed. This shall include parent material, stitching, and netting.
2. The minimum mat thickness shall be 3/8 inch (9 mm) as measured in place.
3. All products approved in this category will be allowed on slopes up to 4:1.
4. Slopes that are between 4:1 and 2.5:1 are required to have double netting.
5. The netting shall be stitched, with biodegradable yarn, to prevent separation of the net from the parent material.
6. The netting shall be capable of withstanding moderate foot traffic without tearing or puncturing, and shall be in accordance with section 628 of the WisDOT Standard Specifications.
7. Neither the netting, nor the installation, shall pose a safety risk to pedestrians walking on, or crossing it
8. The erosion mats shall not be overlapped more than 3 inches during installation
9. All mats shall be anchored with approved systems for urban applications.

TYPE A
(No Minimum Product Permissible Shear Stress Required) A single or double netted product for use on slopes 4:1 and flatter.

TYPE B

(Minimum Product Permissible Shear Stress: 1.0 LBS/sq. ft. (50 Pa)); A double netted product for use on slopes 2.5:1 and flatter.

Anchoring Devices (URBAN)

1. All materials and additive components that are used to manufacture the anchoring devices shall be completely biodegradable as determined by ASTM D 5338-92.

2. All materials shall be environmentally safe, and shall have no potential for soil and/or water contamination.

3. Steel wire pins or staples will not be approved.

4. Petroleum based plastics or composites containing petroleum based plastics will not be allowed.

5. Materials deemed to present a hazard from splintering or spearing will not be approved. This shall include solid wood devices. However, devices manufactured from wood byproducts may be approved.

6. The anchoring devices shall maintain their mechanical anchoring ability for at least 2 (two) months, and substantially degrade within 4 (four) months during the months of warm soil conditions (above 53 degrees Fahrenheit).

7. The anchoring devices shall be shaped, using barbs, twists, bends, or other methods, to provide additional mechanical pull resistance when installed in the soil.

APPROVED CLASS I EROSION MATS

Class I Type A

PRODUCTS	MANUFACTURER
Curlex Excelsior	**American Excelsior**
Curlex Excelsior II	**American Excelsior**
Curlex High Velocity	**American Excelsior**
QuickGrass	**American Excelsior**
Curlex LT	**American Excelsior**
CS2	**SI Geosolutions**
S1	**SI Geosolutions**
S2	**SI Geosolutions**
ECS High Velocity Excelsior	**Erosion Control Systems**
ECS High Velocity Straw	**Erosion Control Systems**
ECS Standard Excelsior	**Erosion Control Systems**
ECS Standard Straw	**Erosion Control Systems**
Earth-Lock IB	**Erosion Control Systems**
S75	**North American Green**
S150	**North American Green**
SC150	**North American Green**
Excelsior	**PPS**

XCEL Regular R1	**PPS**
XCEL Superior S2	**PPS**
XCEL Super Duty SD3	**PPS**
Verdyol High Velocity ERO-Mat	**Verdyol Alabama, Inc.**
Verdyol High Velocity Excelsior	**Verdyol Alabama, Inc.**
Verdyol Standard ERO-Mat	**Verdyol Alabama, Inc.**
Verdyol Standard Excelsior	**Verdyol Alabama, Inc.**
*** DS75**	**North American Green**
*** DS150R**	**North American Green**
*** Curlex I**	**American Excelsior**
*** Curlex II**	**American Excelsior**
*** SFID**	**SI Geosolutions**
S31	**Erosion Control Blanket.com**
S32	**Erosion Control Blanket.com**
S100	**TNS**
S200	**TNS**
AEC Premier Straw (single net)	**American Excelsior**
AEC Premier Straw (double net)	**American Excelsior**

*** Products shall be netted, photodegradable and are not be installed after September 1st.**

Class I Type B

PRODUCTS	MANUFACTURER
Curlex High Velocity	**American Excelsior**
Curlex Excelsior II	**American Excelsior**
Curlex LT	**American Excelsior**
CS2	**SI Geosolutions**
S2	**SI Geosolutions**
Earth-Lock IB	**Erosion Control Systems**
ECS Earthlock	**Erosion Control Systems**
ECS High Velocity Excelsior	**Erosion Control Systems**
ECS High Velocity Straw	**Erosion Control Systems**
S150	**North American Green**
SC 150	**North American Green**
XCEL Super Duty SD3	**PPS**
XCEL Superior S2	**PPS**
Verdyol High Velocity ERO-MAT	**Verdyol Alabama, Inc.**
Verdyol High Velocity Excelsior	**Verdyol Alabama, Inc.**
S32	**Erosion Control Blanket.com**
S200	**TNS**

AEC Premier Straw (double net)	**American Excelsior**

Class I, Urban, Type A

PRODUCTS	MANUFACTURER
ENS 1	**SI Geosolutions**
ENS 2	**SI Geosolutions**
ENCS 2	**SI Geosolutions**
ENC 2	**Bon Terra**
S 75 B	**North American Green**
S 150 BN	**North American Green**
SC 150 BN	**North American Green**
C 125 BN	**North American Green**
Curlex I Fibernet	**American Excelsior**
Curlex II Fibernet	**American Excelsior**
AEC Premier Straw Blanket, Jute netting, single and Double	**American Excelsior**

Class 1, Urban, Type B

No products are presently approved in this category.

ANCHORING DEVICES FOR CLASS I, URBAN EROSION MAT

PRODUCT	MANUFACTURER
CF Bio Staple	**CFM Corp.**
Bio-Stake	**North American Green**
Enviro-Stake	**ODC Inc.**

CLASS II

A long term duration (3 years or greater), organic, "Erosion Control Revegetative Mat" (ECRM).

For those Class II mats that have netting attached, the netting shall be photodegradable and/or biodegradable as specified for that Class and Type of mat. The weight of the netting shall not exceed 15% of the total blanket weight.

The netting shall be bonded sufficiently to the parent material to prevent separation of the net from the parent material for the life of the product. This is particularly important as the vegetation starts to grow. If found deficient at the bond the product will be removed from the PAL. The net if not bonded sufficiently, has a

tendency to float as the vegetation grows and may cause damage to maintenance equipment when slopes are mowed and increases the risk of animals being caught in the netting.

TYPE A - Jute fiber only

Jute fabric intended for use as erosion mat shall be a woven fabric of a uniform open weave of single jute yarn. The jute yarn shall be of loosely twisted construction having an average twist of not less than one and one-half turns per inch. The average size of the warp and weft yarns shall be approximately the same. The woven fabric shall be furnished in rolled strips. The minimum width of the strips shall be 48 inches (1200 mm) with a tolerance of plus or minus 1.0 inch (25 mm). The strip shall have 78 warp ends, plus or minus two, per linear yard (.914 m) of length. The weight of the fabric measured under average atmospheric conditions shall be 92 pounds per 100 square yards (42 kg per 84 m^2) plus or minus ten percent. The fabric shall be non-toxic to vegetation.

TYPE B

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): For use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less. Non-organic, photodegradable or biodegradable netting allowed.

TYPE C

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): For use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less. Only 100% organic fibers allowed. Only woven mats are allowed with a maximum opening of ½ inch (12 mm). **Recommended for use in environmentally sensitive areas.**

Class II Types B& C Fiber Longevity

The parent material of Class II Type B & C mats shall have a maximum water absorption rate of 300%, by weight, as per ASTM D1117; and a maximum swell (wet thickness change) of 30% as per ASTM D1777. The lignin content shall be greater than 38%, as determined by the [1]Klason method.

[1]Technical Association of the Pulp and Paper Industry Test Method**,** Acid Insoluble lignin in wood and pulp, T222 om-98

APPROVED CLASS II TYPE EROSION MATS

CLASS II TYPE A

100% Jute Mats only no specific products lines identified.

CLASS II TYPE B

PRODUCTS	MANUFACTURER
C2	SI Geosolutions
CP 2	SI Geosolutions
C125	North American Green)
C125BN	North American Green)
C350	North American Green)
CF072RP	Greenfix America
S400	TNS

CLASS II TYPE C

PRODUCTS	MANUFACTURER
Dekowe 700	Belton Industries
Dekowe 900	Belton Industries
CF7	SI Geosolutions
CF9	SI Geosolutions
BioD-Mat 70	RoLanka

CLASS III

A permanent, 100% synthetic "Erosion Control Revegetative Mat" (ECRM) or "Turf Reinforcement Mat" (TRM).

WisDOT DEFINITION OF TRM and ECRM: WisDOT distinguishes a TRM (Turf Reinforcement Mat) from an ECRM (Erosion Control Revegetative Mat) as follows:

TRM's are designed to be filled with soil when installed. ECRM's are designed to be placed on top of soil.

TYPE A

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa): An ECRM mat, as opposed to a TRM mat, for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less.

TYPE B

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): A TRM mat for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less.

TYPE C

(Minimum Product Permissible Shear Stress: 3.5 lbs/ft² (170 Pa)): A TRM mat for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 3.5 lbs/ft² (170 Pa) or less.

TYPE D

(Minimum Product Permissible Shear Stress: 5.0 lbs/ft² (240 Pa)): A TRM mat for use on slopes 1:1 or flatter, or in channels when the calculated (design) shear stress is 5.0 lbs/ft² (240 Pa) or less.

TRM's shall be continuously bonded at the filament intersections. Filaments, which are discontinuous or loosely held together by woven, stitched or glued, netting, for example, will not be permitted in this category.

TRM'S REQUIRED MINIMUM THICKNESS AND AREA HOLDING CAPACITY:

TRM Categories	Minimum Thickness	Minimum Area Holding Capacity In^3/Yd^2 (L/m^2)

	Inches (mm)	
Type B	10 (0.4)	8.8 (450)
Type C	18 (0.7)	17.6 (900)
Type D	18 (0.7)	17.6 (900)

Class III - Type B, C and D "Turf Reinforcement Mats" (TRM) are permanent, 100% synthetic, open-weaved mats that shall be continuously bonded at the filament intersections. **WisDOT requires that all classes of TRM mats shall be completely filled with top soil immediately after installation.** Loosely packaged discontinuous filaments are not permitted in this category.

To prevent initial soil loss, Class III TRM mats, Type B, Type C, and Type D, must be covered with one of the following materials during installation: (These materials shall be considered **incidental** to the installation of Class III TRM mats)

FOR SLOPE APPLICATION

1. An approved “Interim Soil Stabilizer Type A”
2. An approved ECRM mat for slope applications

FOR CHANNEL APPLICATION
1. An approved ECRM mat for channel applications

APPROVED CLASS III TYPE EROSION MATS

Class III Type A

PRODUCTS	MANUFACTURER
Pek Mat	American Excelsior
SFB	SI Geosolutions
SFB12	SI Geosolutions
Tensar TB 1000	Earth Technologies, Inc.
Miramat 1800, 2400	Nicolon Mirafi
P300	North American Green
Contech C-45	SI Geosolutions
Contech C-60	SI Geosolutions
Landlok ECRM 450	SI Geosolutions
Landlok ECRM 450S	SI Geosolutions
Landlok TRM 1060	SI Geosolutions
Landlok TRM 1060S	SI Geosolutions

Class III Type B

PRODUCTS	MANUFACTURER
Enka S	Colbond Geosynthetics
Enkamat 7010	Colbond Geosynthetics
Enkamat 7018	Colbond Geosynthetics
Enkamat 7020	Colbond Geosynthetics.
Tensar tm3000	Earth Technologies, Inc.
Miramat TM8	Nicolon Mirafi
Pyramat	SI Geosolutions

Class III Type C

PRODUCTS	MANUFACTURER
Enka S	Colbond Geosynthetics
Pyramat	SI Geosolutions
Enkamat 7020	Colbond Geosynthetics

Class III Type D

PRODUCTS	MANUFACTURER
Enka S	Colbond Geosynthetics

TACKIFIERS

The list shown below is WisDOT's Product Acceptability List (PAL) for Tackifiers. Products in this category must meet or exceed the minimum requirements of Michigan Department of Transportation's Qualified Product List. WisDOT **will not** approve any **asphalt based** products or any product deemed environmentally incompatible. Tackifiers shall be mixed and applied in accordance with the manufacturers published directions.

General Specifications

1. Latex-Base: The components for the latex-base adhesive shall meet the following requirements: The composition, by weight, of the latex emulsion polymer shall be 48 percent Styrene, 50 percent Butadiene, and 2 percent additive; 42.0-46.0 percent solids; and a PH, as shipped, of 8.5 to 10.0. The emulsion shall not be allowed to freeze or to be exposed to sunlight for a prolonged period of time.

2. Paper fiber Tackifier: Recycled newsprint mulch shall consist of specifically prepared, biodegradable, shredded paper particles, consisting of recycled newsprint fibers. The recycled newsprint shall contain a wetting agent, deforming agent, and nontoxic dyestuff that will impart a bright green or blue color to aid in visual metering during construction. The dyestuff shall adhere tightly to the fiber, minimizing leaching of the color after application. Recycled Newsprint Fiber shall meet the following minimum requirements:

Moisture Content.....……Maximum of 12%, +/-3%
Shredded High-Grade Newsprint (Oven Dry).... Minimum of 96%
Tackifier by Weight.....……1.5% to 3%
Water Holding Capacity.....……..Minimum 900 g (Water per 100 g of Fiber)

3. Excelsior Tackifier. Specially prepared, biodegradable, air-dried virgin wood fibers manufactured from 100% whole wood chips. Recycled materials shall not be allowed. The wood fiber shall be manufactured with a tackifier. The fibers shall be dyed with a green or blue biodegradable to aid in visual metering during construction. The process and materials shall not contain growth or germination inhibiting materials. The wood fiber hall conform to the following specifications:

Moisture Content (Total Weight)..……..Maximum 12%
Organic Wood Fiber (Oven Dry).....……..Minimum 95%
Tackifier by Weight.....……Minimum 3% to 5%
Water Holding Capacity .....……...Minimum 1000 g (Water per 100 g of fiber)

4. Guar Gum. Guar gum tackifiers shall consist of a minimum of 95% Guar gum by weight; the remaining shall consist of dispersing and cross-linking additives.

5. Other Tackifiers. Other tackifiers shall include the following but not limited to: water soluble natural vegetable gums or guar gums blended with gelling and hardening agents or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums.

Construction Methods

Mulch Anchoring. Anchoring of the mulch shall be accomplished by spraying the tackifier immediately after the mulch has been placed. Spraying shall not be performed during periods of windy conditions that would prevent the proper placement of adhesive. The Contractor shall protect all traffic, signs, structures, and other objects from being marked or disfigured by the tackifier material. The tackifiers shall be applied at the following minimum rates per hectare:

1. Latex-Base: mix 37 gal (140 L) of adhesive or the manufacturers recommended rate which ever is greater with a minimum of 620 LB (280 kg) of Recycled Newsprint as a tracer with 925 gallons (3.5 kl) of water.

2. Paper fiber Tackifier: mix 1850 LB (840 kg) of newsprint with 3,700 gallons (14 kl) of water.

3. Excelsior Tackifier: mix 1850 LB (840 kg) of wood fiber with 3,700 gallons (14 kl) of water.

4. Guar gum: mix 120 LB (55 kg) of dry adhesive and a minimum of 620 LB (280 kg) of Recycled Newsprint as a tracer with 3,225 gallons (12.2 kl) of water.

5. Other Tackifiers: (Hydrophilic Polymers) mix 110 kg (240 LB) of dry adhesive or the manufacturer's recommended rate which ever is greater and a minimum of 280 kg (620 LB) recycled newsprint as a tracer with 3,225 gallons (12.2 kl) of water.

APPROVED TACKIFIERS

LATEX BASE ADHESIVE

PRODUCTS	MANUFACTURER
BUTOFAN NS 268	BASF Corp.

PAPER FIBER TACKIFIER

PRODUCT	MANUFACTURER
Greenstar Professional Mulch	Amturf Seeds, Inc.
Applegate Mulch	Applegate Insulation System, Inc.
Cellin Fiber Mulch	Cellin Manufacturing, Inc.
Nu-Wool Hydroseeding Mulch	Nu-Wool, Inc.
Utica Hydro Mulch	Utica Distributors

EXCELSIOR TACKIFIER

PRODUCT	MANUFACTURER
Excel Fiber Mulch	American Excelsior Co.
ConWed 2000	ConWed
Refiber Mix w/TAC	Wood Recycling Inc.
Refiber Wood w/TAC	Wood Recycling, Inc.

GUAR GUM BASE ADHESIVE

PRODUCT	MANUFACTURER
Lawn Tack	Amturf Seeds
Second Nature Tacpac GTX	Central Fiber Corp.
Finn A500 Hydro-Stik	Finn Corporation
Eco Tak-OP	Eastern Products Inc.
Landtack	Erosion Control Technologies

OTHER TACKIFIERS (Hydrophilic Polymers)

PRODUCT	MANUFACTURER
Exact-Tac (E-T)	American Excelsior Co.
Con-Tack A/T	Con Wed
Eco Tak-SAT	Eastern Products Inc.
RMB Plus	Reinco Co.

SOIL STABILIZERS

General Requirements For Soil Stabilizers

Soil stabilizers are intended as soil bonding agents to prevent or minimize erosion of bare soil. They must be harmless to fish, wildlife, and plants; along with being non-toxic and non-combustible. All products submitted for approval will undergo initial screening by WisDOT. Products selected via the screening process shall be field tested and placed on the PAL if approved. Refer to appendix D for WisDOT test protocol. **Asphalt based products will not be approved for use as soil stabilizers.**

Soil stabilizers are considered a short term duration (6 months or less) erosion control device. When used alone, they shall be used on slopes 3:1 or flatter. They shall **not** be used in channels.

In addition to the above requirements soil stabilizers must meet the same vegetative density and sediment loss standards required for erosion mats.

TYPE A

Soil stabilizer, Type A, shall be a cementitious soil binder added to wood cellulose fiber mulch, or a bonded fiber matrix. They are intended to form a thick heavy bodied crust or mat like barrier that controls water and wind induced erosion. Soil Stabilizer, Type A, is approved for use on Class III, Type B, C, and D erosion mats where those mats are used on slope applications.

TYPE B

Soil stabilizer, Type B, shall be a polyacrylamide (PAM) and calcium solution intended to reduce the erodibility of bare soils during construction activities or to enhance the performance of mulching on permanent slopes. Soil stabilizer, Type B, shall have proven abilities to bond soil particles, effectively increasing the soil particle size to 1.0 mm or larger. It shall reduce the movement of soil through chemical bonding, increase the particle size thus making silt fence more effective, and increase the water absorption of the soil.

Only the anionic form of PAM shall be used. Cationic PAM is toxic and shall not be used. PAM and PAM mixtures/additives shall be environmentally compatible, harmless to fish, wildlife and plants. They shall be non-combustible. Detailed information on all additives shall be provided to the Wisconsin Department of Transportation.

Anionic PAM, in pure form shall have no more than 0.05% acrylic monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency. To maintain the ≤ 0.05% acrylic monomer content, the application rate for PAM, in its pure form, on slopes and channels,

shall not exceed 200 lbs/acre (224 kg/ha).

Manufacturers of PAM and PAM mixtures/additives may request approval of their products by following the procedure detailed on page *v* of this document. In addition the manufacturer shall supply acute and chronic toxicity test reports from a state certified testing laboratory. The toxicity test report shall be reviewed by the Wisconsin Department of Natural Resources (WDNR). The outcome of the WDNR review and the WisDOT field performance test results shall determine whether or not a product is placed in the PAL.
The manufacturer shall also supply certified test data confirming that the material achieved no less than 80% reduction in soil loss induced by a 2 inch per hour (50 mm/hr) rainfall simulator, as detailed in **Sprinkler Infiltrometer Test**[1].

Construction Methods

1. Application for Soil Stabilizer, Types A & B is intended to be done with conventional hydraulic seeding equipment. Soil Stabilizer, Type B, may also be placed through dry spreading. When dry spreading is used, the contractor must ensure that the material is applied uniformly. The manufacturer shall provide detailed instructions on the storage, mixing and application procedures to insure proper safety and effectiveness of the product.

2. Seeding must be done in a manner that ensures direct contact with the soil. For Soil Stabilizer, Type A, seed must be sown separately and prior to the application of the soil stabilizer.

3. Application rates shall be as recommended by the manufacturer and shall meet the approval of the project engineer. However, Soil Stabilizer, Type A shall be a minimum of 1/4 inch (6 mm) thick.

4. For Soil Stabilizer, Type B, when used on permanent slopes, WisDOT approved mulch must be applied to protect the seed.

[1]Peterson AE; Bubenzer GD; Klute A, "Intake rate: sprinkler infiltrometer", Methods of soil analysis, Part 1, Physical and mineralogical methods, 1986, 845-870.

APPROVED SOIL STABILIZERS

TYPE A

PRODUCTS	MANUFACTURER
Airtrol Plaster	Calfate Products Inc.
Weyerhaeuser Soil Guard	Weyerhaeuser Corp.

TYPE B

PRODUCT	MANUFACTURER
CFM 2000	CFM Corp.

INLET PROTECTION

General Requirements of Inlet Protection

Application

Inlet protection products are intended to intercept, pond, and filter sediment-laden runoff. They generally consist of geotextile fabric and fabric hold down systems for inlet protection as shown on the Department's details or plans. All fabrics used as part of an inlet protection must be included on the list of fabrics certified for Inlet Protection, Geotextile Fabric, Type FF in the current edition of the PAL. Approved manufactured products used as alternatives to the Department's Standard Details are listed below will also be manufactured of Type FF Fabric.

The Department will include a listing of acceptable fabrics for Inlet Protection, Geotextile Fabric, Type FF in the Product Acceptability List. These lists will remain effective for only the calendar year in which they are published. To be considered for certification, suppliers or manufacturers of geotextiles must submit products to the Department. Such submittals for the current calendar year may be made at any time prior to July 31. Submittals for inclusion in the PAL for the coming calendar year will be accepted by the Department beginning on November 15.

Materials

Product acceptance will be based on compliance with the following requirements.

Product Material: Woven polypropylene.

Physical Properties:

Test	Method	Value[(1)]
Grab Tensile Strength, lb. (N)	ASTM D-4632	200 (900) min.
Puncture Strength, lb. (N)	ASTM D-4833	105 (460) min.
Apparent Breaking Elongation, Machine Direction, %	ASTM D-4632	24 min.
Apparent Breaking Elongation, Cross Direction, %	ASTM D-4632	10 min
Apparent Opening Size, μm	ASTM D-4751	600 max.
Permittivity, s^{-1}	ASTM D-4491	1.9 min.

[(1)]All numerical values represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

Certification Procedures

To be considered for certification, the supplier or the manufacturer must supply the PAL Committee with the following items for each product submitted.

1. Certified Report of Test and Analysis showing full compliance with the listed requirements.

2. Three samples of the material obtained from separate rolls of material. Each sample shall be a minimum of 3 feet in length and the full width of the roll.

Product acceptability will be determined by Department under the administration of the PAL Committee. No product will be considered for certification without the receipt of an acceptable Certified Report of Test and Analysis. In addition, the Department will conduct laboratory testing of the received samples. Initially, two of the received samples will be tested for compliance with the listed requirements. If both samples are in full compliance, the product will be certified. If both samples fail to meet full compliance, the product will be rejected. If one of the samples fails to meet full compliance, the third sample will be tested and certification or rejection will be based on the test results of that sample.

Field Control

The Department reserves the right to conduct random testing of Geotextile Fabric, Type FF used as part of an inlet protection. If a selected sample fails to meet the specified requirements, the Department will obtain an additional sample of this material from the supplier or manufacturer for testing purposes. If this sample fails to meet the specified requirements, the Chair of the PAL Committee will notify the supplier and/or the manufacturer that the product has failed random testing and that it has been removed from the list of certified fabrics in the current PAL. The supplier or the manufacturer may submit the product for re-certification by following the outlined procedures, but the product will not be returned to the list of certified fabrics until the Department determines that it again meets the requirements of the certification process.

The contractor has the responsibility of providing identification of the fabric supplied for inlet protection units. Such identification shall be attached to the unit and shall allow the project manager to determine if the supplied material is on the list of certified materials for Inlet Protection, Geotextile Fabric, Type FF contained in the current PAL. Failure to supply such identification with an inlet protection unit is sufficient grounds for rejection.

TYPE A

Inlet protection Type A shall be utilized around field inlets until permanent stabilization methods have been established. Inlet protection Type A shall be

utilized on pavement inlets prior to installation of curb and gutter or pavement.

TYPE B

Inlet protection Type B shall be utilized on street inlets without curb head, once surrounding surfaces are in place.

TYPE C

Inlet protection Type C shall be utilized on street inlets with curb heads. A 1 ½" x 3 ½" (37mm by 87 mm) minimum, piece of wood shall be wrapped and secured in the fabric and placed in front of the curb head as shown in the plans. The wood shall not block the entire opening of the curb box.

TYPE D

Inlet protection Type D shall be utilized in areas where other types of inlet protection are identified as incompatible with roadway and traffic conditions causing possible safety hazards when ponding occurs at the inlet. The inlet protection shall have an overflow capacity opening of at least 60% of the grate opening and shall be flush or below the top of the grate elevation.

APPROVED INLET PROTECTION

TYPE A

PRODUCT	MANUFACTURER
Grate Inlet Protector, PCD-1000	Suntree Isles Inc.
Verti - Pro	Alpine Stormwater Management Co.

TYPE B

PRODUCT	MANUFACTURER
Dandy Bag	Dandy Products Inc.

TYPE C

PRODUCT	MANUFACTURER
Beaver Dam	Dandy Products Inc.
Silt Screen	Alpine Stormwater Management Co.

GEOTEXTILE FABRIC TYPE FF

PRODUCT	MANUFACTURER
Filterweave 401	Mirafi
GTF 403	Linq

TEMPORARY DITCH CHECKS

Purpose & Operation

Products in this category are intended to be utilized at the bottom of fill slopes and in channels to intercept and pond sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the sediments to settle out. Water exists the check by either filtering through or flowing over the top.

Construction Methods

This work shall be in accordance with the requirements of section 628 of the State of Wisconsin Department of Transportation Standard Specification for Highway and Structure Construction, and the "Typical Installation of Erosion Bales" Standard Detail Drawing # 8E 8-2 in the WisDOT Facility Development Manual. In addition to the above, temporary ditch checks shall be placed perpendicular to the flow line of the ditch and shall extend far enough so that the ground level at the ends of the checks are higher than the low point on the crest of the check. The installed material shall have a minimum height of 10 inches (25.4 cm) above the flow line in the installed condition. Log type products shall be installed as per the WisDOT "Typical Erosion Bales" Standard Detail Drawing stated above. All products shall be entrenched as per the detail. Fabric type products may be entrenched with a narrow check slot on the upstream side.

Approved manufactured alternatives to the Department's details are listed below.

APPROVED TEMPORARY DITCH CHECKS

PRODUCT	MANUFACTURER
Bio Wattle FX	**Bon Terra**
Curlex Sediment Log	**American Excelsior**
Triangular Silt Dike	**Triangular Silt Dike**

IN-STREAM SEDIMENT TRAP

Purpose & Operation

In-Stream sediment traps are intended for use in streams or channels to trap and remove or stabilize sediments during in-stream construction activities. The product consists of a flat pad with protruding vanes designed to trap sediment within the confines of a concentrated flow area or stream. The pad, which is placed singularly or in a group on the stream-bed immediately downstream of a disturbed area, filters out the sediment carried by the stream current or water runoff.

Construction Methods

Mats shall be placed at locations shown on the plans or as directed by the engineer. Mats shall be installed flat on the stream bed to intercept and retain sediments caused by in stream activities. It shall be anchored by staking or other methods approved by the engineer. Overlap of the trailing edge of upstream mats and sides of adjacent mats shall be a minimum of 6 inches or 150 mm. When ordered by the engineer, mats shall be replaced or removed. Care shall be taken during removal to minimize loss of entrapped sediments.

These products shall only be used in streams with the concurrence of WisDNR.

APPROVED IN-STREAM SEDIMENT TRAP

PRODUCT	MANUFACTURER
Sedimat	**Indian Valley Industries**

ARTICULATED CONCRETE BLOCK REVETMENT SYSTEMS

Purpose & Operation

Articulated concrete block revetment systems are a flexible manufactured erosion control system that is able to expand and contract with the subgrade. The systems are made of individual concrete block units, which are physically integrated through mechanical interlock, cables, grids, or other means to produce an erosion-resistant lining. The articulated concrete blocks are organized into five types based upon sustaining a minimum permissible shear stress.

General Specifications

1. Bed Shear Stress: All articulated concrete block systems are placed in categories based upon performance at an adequate testing facility meeting protocols and procedures as described in this section. In order to be placed in a particular category, an articulated concrete block system must perform to a minimum product permissible bed shear stress in a channel and meet the minimum permissible bed shear stress for that category. For example, articulated concrete block systems placed in an Open Class Type E category must withstand a minimum product permissible bed shear stress of 1425Pa (30 lbs/ft^2). See item #2 under the general specifications for specific testing requirements and documentation.

2. Testing Procedure and Documentation: All articulated concrete block systems must be tested in accordance with FHWA-RD-88-181 or FHWA-RD-89-199 and a minimum slope of 2:1 prior to being placed on WisDOT's Erosion Control Product Acceptability List (PAL). Articulated concrete block systems must be installed as tested. This includes anchors, drainage nets, and cables.

It is recognized by WisDOT that some systems utilize a cable for installation purposes. However it is also possible that the cable can enhance the performance of the system. Therefore, any system, which is tested with a cable and placed in a specific category, must be installed with a cable. This does not prevent systems, which were not tested with cables to be installed with cables. Articulated Concrete Block Revetment systems, which do not have a positive interlock at least in one direction, are required to use cables for installation and testing. Positive interlock is defined as block that is united firmly in a direction of forward motion such as by hooking or dovetailing.

It is also recognized by WisDOT that some testing facilities will use a turf reinforcement mat similar to a Class III Type D in order to place water monitoring devices required for the testing. This practice is consistent with the procedure that was completed in the FHWA-RD-89-199 report. Mats or other devices used for this purpose will not be required in the field.

The hydraulic conditions at the threshold of failure determine the hydraulic stability of a systems performance. Failure of a system is defined as the "loss of intimate contact between an articulating concrete block system and the subgrade soil"

All systems must be tested as full scale production units in order for extrapolation to be accepted for inclusion on WisDOT's PAL. To be considered for WisDOT's Erosion Control Product acceptability List, the following reporting information is required to be performed at an independent testing facility and reported by a licensed professional engineer.

- Description of the testing facility, including plan/profile schematics, water management scheme, measurement devices and instrumentation, and maximum flow capabilities.
- Description of revetment system, including dimensioned drawings of block components, description of infill material (if used), geotextile properties, and any ancillary features such as cables, anchors, connectors, etc.
- Computations and a diagram of a 10 foot by 10 foot area of the system determining percent open area measured at the bottom of the block.
- Documentation of embankment soil properties and description of embankment construction methods.
- Description of revetment installation, including wall details, crest and toe terminations, method of interlock, and ancillary components such as anchors, cables, grids etc. Include photographs illustrating relevant aspects.
- Description of the testing procedures, including the overtopping depth(s) and discharge(s) examined, data collection procedures, and qualitative description of revetment system performance. Include photos of tests in progress and post test revetment system condition.
- Summary of measured data and calculated hydraulic conditions for each test.
- Discussion of the identification (interpretation) of stability threshold location and hydraulic conditions, with supporting calculations.
- Calculations of any extrapolated data for revetment systems of varying thickness of the same family of block. Note that extrapolation will only be accepted from testing on full scale production units.
- Appendix containing raw data and measurements.

3. Materials

General: The articulated concrete block revetment system and all materials used to manufacture the system shall have a minimum effective life span of 50 years.

Concrete: The concrete used to manufacture the individual blocks shall meet a compressive strength of 4000 psi using ASTM-C-140 for dry cast products and ASTM-C-39 for wet cast products. Cast concrete blocks shall conform to ASTM-C-1262 in a 3% saline solution at forty (40) cycles and not to exceed a 1% loss of its initial weight. or shall conform to ASTM C 666, the block shall retain 80% of the relative dynamic modulus with no more than 1% loss of initial weight. Compliance with these

procedures shall be accomplished by certification from an AMRL (A.A.S.H.T.O. Material Registered Laboratory) certified plant. This Certification shall be done when a change is incurred in the mix design, supplying plant, and/or source materials in addition to yearly recertification.

Cable: For articulated concrete block systems that utilize cables during the testing procedure, the cables shall have a tested effective life span of 50 years. A minimum factor of safety of 5 shall be applied to the cables for lifting and placing purposes.

4. Installation: Articulated concrete block systems shall be built in a reasonably close conformity to the lines, grades, dimensions, details and design indicated on the plans in accordance with the pertinent requirements of the specifications for all work necessary to complete the work in accordance to the contract. The contractor will be responsible for supplying the department with the design of anchor trenches, side trenches and toe trenches to ensure a surface that is flush with the top surface of the articulating concrete mat.

5. Filter Fabric: All articulating concrete mats approved for WisDOT use shall be installed with a filter fabric beneath the mat that meets the following specifications.

Test	Method	Value[1]
Grab Tensile Strength	ASTM D 4632	1450 N (320 lbs) min
Puncture Strength	ASTM D 4833	510 N (115 lbs) min
Apparent Breaking Elongation Machine Direction	ASTM D 4632	26% min
Apparent Breaking Elongation Cross Direction	ASTM D 4632	15% min
Apparent Opening Size	ASTM D 4751	600um (30 US Std. Sieve)
Permittivity	ASTM D 4491	2.14 sec^{-1}
Permeability	ASTM D 4491	.142 cm/sec

[1] All numerical values represent minimum average roll values (i.e., the average of the minimum test results on any roll in a lot should meet or exceed the minimum specified values.

6. Quality Assurance: For quality assurance WisDOT will conduct random tests on selected projects to determine if the supplied blocks meet the specifications. If they do not meet the specifications, the project engineer will determine a credit to the project in accordance with section 105.3 of the State of Wisconsin, Standard Specifications for Highway and Structure Construction. The credit will not exceed the cost of replacement of the blocks including labor of installation, and removal of the old blocks. Subsequently the block supplier / manufacturer will be removed from the list.

7. Recertification: To remain on the approved list all block suppliers must resubmit freeze thaw and strength testing by an approved AMRL lab by October first of each year.

Class and Type Specifications

Class Open Cell

(Open cell articulated concrete block systems must have a minimum open area of 20% measured at the bottom of the block for the system.)

Type A: (Minimum Product Permissible Bed Shear Stress: 240 Pa (5 lbs/ft^2)

Type B: (Minimum Product Permissible Bed Shear Stress: 475 Pa (10 bs/ft^2)

Type C: (Minimum Product Permissible Bed Shear Stress: 715 Pa (15 lbs/ft^2)

Type D: (Minimum Product Permissible Bed Shear Stress: 950 Pa (20 lbs/ft^2)

Type E: (Minimum Product Permissible Bed Shear Stress: 1425 Pa (30 lbs/ft^2)

Class Closed Cell

(Closed Cell articulated concrete block systems are systems that have a maximum open area of 10% measured at the bottom of the block in the system.)

Type A: (Minimum Product Permissible Bed Shear Stress: 240 Pa (5 lbs/ft^2)

Type B: (Minimum Product Permissible Bed Shear Stress: 475 Pa (10 bs/ft^2)

Type C: (Minimum Product Permissible Bed Shear Stress: 715 Pa (15 lbs/ft^2)

Type D: (Minimum Product Permissible Bed Shear Stress: 950 Pa (20 lbs/ft^2)

Type E: (Minimum Product Permissible Bed Shear Stress: 1425 Pa (30 lbs/ft^2)

APPROVED ARTICULATED CONCRETE BLOCK REVETMENT SYSTEM

Closed cell

TYPE A

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

Type B

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

Type C

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

TYPE D

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

APPROVED ARTICULATED CONCRETE BLOCK REVETMENT SYSTEM (cont.)

TYPE E

Closed cell

Product	Manufacturer	Plant Name / location
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

Open cell

TYPE A

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN

TYPE B

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

TYPE C

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

APPROVED ARTICULATED CONCRETE BLOCK REVETMENT SYSTEM (cont.)

Open cell

TYPE D

Product	Manufacturer	Plant Name / location
PL-41216	Geolink	Eulls Manufacturing; St. Michael, MN
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

TYPE E

Product	Manufacturer	Plant Name / location
PL-61216	Geolink	Eulls Manufacturing; St. Michael, MN
H-41216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-61216	Petraflex	Eulls Manufacturing; St. Michael, MN
H-91216	Petraflex	Eulls Manufacturing; St. Michael, MN

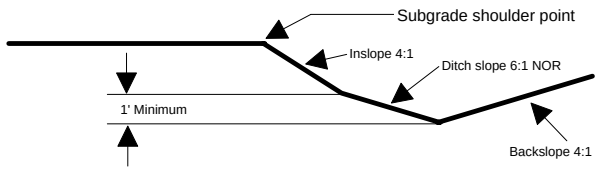
CHANNEL EROSION CONTROL MATRIX
(CONCENTRATED FLOW APPLICATIONS)

TYPE OF EROSION CONTROL	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE															REMARKS
		1% - 2%			2% - 4%			4% - 6%			6% - 9%*			9% - 12%*			
		MAX. DITCH LENGTH			MAX. DITCH LENGTH			MAX. DITCH LENGTH			MAX. DITCH LENGTH			MAX. DITCH LENGTH			
		300'	600'	>600'	300'	600'	>600'	300'	600'	>600'	300'	600'	>600'	300'	600'	>600'	
Permanent seed with temporary seed and mulch	0.6	—	S C	C													Oversow with temporary seed at one half normal application rate.
Sod ditch checks with seed and mulch	—	—	—	—	S	C											Install one ditch check for every 1 foot of drop. Sod stakes required.
Erosion bale ditch checks	—	—	—	—	—	—	S C										Install one ditch check for every 2 feet of drop. Maximum 100' spaces.
Sod ditch liner	1	—	—	—	—	—	S C										Upstream end must be buried. Additional sod stakes required.
Class I Type B erosion mat liner	1.5	—	—	—	—	—	—	S C									Only mat type products allowed.
Sod reinforced with Class II Type A jute ditch liner	1.5	—	—	—	—	—	—	S C	C								Upstream end must be buried. Additional sod stakes required. Two bid items needed.
Stone or rock ditch checks	—	—	—	—	—	—	—	—	—	S C							Could use No. 2 couple ???? railroad ballast, or breaker run. Install one ditch check for every 2 feet of drop.
Class II Type B or C erosion mat liner	2	—	—	—	—	—	—	—	—	S C							
Class III Type A or B erosion mat liner	2	—	—	—	—	—	—	—	—	S C							Germination may be a problem with Class III Type A. For Type O,A soil stabilizer is required for initial erosion protection.
Class III Type C erosion mat liner	3.5	—	—	—	—	—	—	—	—	—	—	—	—	S C			A soil stabilizer is required for initial erosion protection. Contact manufacturer if higher shears are needed.
Riprap ditch checks	—	—	—	—	—	—	—	—	—	—	—	—	—	S C			Place top of downstream ditch check level with bottom of upstream ditch check.
Class III Type D erosion mat liner	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S C	
Heavy riprap ditch liner	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S C	Outfalling, overtopping and scour need to be addressed. Heavy riprap required, use 2' minimum ditch.
Grouted riprap ditch liners	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S C	Outfalling, overtopping and scour need to be addressed. Must be lined with Grotextile fabric type "HR", (see chapter 10 const. detail and special provision). Use 2' minimum ditch depth.

Effective range of device is indicated by —— and 'S' for sandy soil or 'C' for clay soil.

TYPICAL SECTION

Erosion control for ditches not conforming to the typical at right, that complies with procedure 11-15-1 figure 6 & 7, should be designed according to FDM chapter 13.



NOTES

1) Erosion mats shall extend upslope 1.0 ft. min. vertically from the ditch bottom or 6" higher than the design flow depth. There shall be no joints within 18 inches of the low point.

2) * For ditch grades over 9% special design considerations may be required.

3) Cost shall be a consideration in the selection of these devices.

4) As appropriate these measures should be used in combination.

5) Bar chart is based on a depth of flow of 0.5 ft. except for riprap liners and grouted riprap liners which are based on 1.0 ft. For depth of flows greater than 0.5 ft. use permissible shear stress column (see procedure 10-5-40).

SLOPE EROSION CONTROL MATRIX
(SHEET FLOW APPLICATIONS)

TYPE OF EROSION CONTROL	SLOPE																		Effective range of device is indicated by ——— and 'S' for sandy soil or 'C' for clay soil.
	6:1			4:1			3:1			2.5:1			2:1			1:1			
	SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			REMARKS
	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	
Permanent seed with temporary seed and mulch	———	———	———	———	———	———	———	———	X	S C									Oversow with temporary seed at one half normal application rate.
Class I type A erosion mat	———	———	———	———	———	———	———	———	———	S C									
Class I type B erosion mat	———	———	———	———	———	———	———	———	———	———	———	X	S C						
Sod	———	———	———	———	———	———	———	———	———	———	———	X	S C						
Class II type B or C erosion mat	———	———	———	———	———	———	———	———	———	———	———	———	———	S C					
Sod reinforced with class II type A	———	———	———	———	———	———	———	———	———	———	———	X	S C	S C					Sod stakes required. Two bid items needed.
Class III type A erosion mat	———	———	———	———	———	———	———	———	———	———	———	———	———	———	S C				Germination may be a problem with class III type A mats.
Riprap	———	———	———	———	———	———	———	———	———	———	———	———	———	———	S C				Angle of repose must be considered, see chapter 13.
Class III type B or C erosion mat	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	S C			A soil stabilizer will be required for initial erosion protection.
Class III type D erosion mat	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	S C	A soil stabilizer will be required for initial erosion protection.
Slope paving or grouted riprap	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	S C	Consider clear zone requirements. Only to be used in limited circumstances.
Benches	Consider benches when cuts exceed 20', bench at approximately 15' vertical intervals to collect an drain water. Treat these benches as channels (ditches). Adjust elevations to provide drainage. Consider flumes at transitions.																		
Intersecting embankments	Used to intercept runoff from abutting lands. Flumes may be necessary to direct runoff.																		
Silt fence	Used at toe of slopes to intercept and detain small amounts of sediment.																		
Erosion bale barriers	Used at toe of slopes to intercept and detain small amounts of sediment.																		
Slope drains/flumes	May be necessary on slopes (see channel matrix for design guidance).																		
Sediment traps	Used to trap sediment laden runoff. Could be used at the inlet or outlet end of slope drain.																		

NOTES

1) Cost shall be a consideration in the selection of these devices.

2) Designers should review procedure 10-10-13 prior to selection of erosion mats.

X Not applicable.

APPENDIX C

New Product/Method Preliminary Information Sheet

Wisconsin Department of Transportation
Division of Transportation Infrastructure Development
Technology Advancement Unit

TRADE NAME OF PRODUCT	DESCRIPTION (WHAT IS IT?)	DATE SUBMITTED

RECOMMENDED USES

1. Primary:
2. Alternate:

OUTSTANDING FEATURES OR ADVANTAGES CLAIMED

MANUFACTURER	Address	City	State	Zip

REPRESENTATIVE Name: Firm:	Address Telephone:	City	State	Zip

PRODUCT STATUS

New on Market ☐ Yes ☐ No Year First Introduced: Introduced as Alternate For:

PRODUCT INFORMATION

1. Composition:
2. Cost:
3. Specifications:

Furnished by Mfr.? ☐ Yes ☐ No Availability of Specs.: ☐ Attached ☐ To be Mailed ☐ Not Available

Product Meets the Following Standard Specifications: ☐ AASHTO ☐ ASTM ☐ FED ☐ OTHER:

4. Patented? ☐ Yes ☐ No ☐ Applied For 5. Proprietary Product? ☐ Yes ☐ No Royalty Costs:
6. Product Guaranteed? ☐ Yes ☐ Copy Attached ☐ No Conditions of Guarantee:
7. Will Free Sample be Furnished? ☐ Yes ☐ No Laboratory Analysis Furnished With Sample? ☐ Yes ☐ No
8. Other State/Highway Agencies Approving its Use:

ADDITIONAL INFORMATION

(The back may be used for additional information if necessary)

PERSON FURNISHING INFORMATION

Name: Title:

APPENDIX D

WIS DOT PROTOCOL FOR SOIL STABILIZER, TYPE B FIELDTESTING

Products successfully passing the toxicity review by WisDNR and the rainfall simulator performance testing required and reviewed by WisDOT will be field tested to evaluate long term performance during the time period when the product is most often used. Products that meet all of the above criteria will be reviewed by WisDOT's Erosion Control Product Acceptability List Committee for inclusion on the Erosion Control Product Acceptability List.

1. Products selected for field testing will be installed between November 1st and December 1st of any given year.

2. The test site selected shall have bare soil slopes of at least a 2 ½: 1 slope and a slope length of at least 50 feet.

3. The evaluation shall be done through the ensuing winter and spring months until such time as the permanent vegetation has been established at the opinion of the committee.

4. Documentation shall show that the test section installed with seed and Soil Stabilizer Type B shall achieve a minimum of a 50% reduction in rilling as compared to a control section installed with only seed.

5. Observed vegetative density in the Soil Stabilizer Type B test section shall be equal to or greater than control section at the end of the evaluation period.